

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Teacher Training in Measurement and
Assessment Skills

Buros-Nebraska Series on Measurement and
Testing

1993

5. Teachers' Assessment of Students: Roles, Responsibilities and Purpose Believing is Seeing

Donna Campbell
Arizona Education Association

Follow this and additional works at: <https://digitalcommons.unl.edu/burosteachertraining>

Campbell, Donna, "5. Teachers' Assessment of Students: Roles, Responsibilities and Purpose Believing is Seeing" (1993). *Teacher Training in Measurement and Assessment Skills*. 7.
<https://digitalcommons.unl.edu/burosteachertraining/7>

This Article is brought to you for free and open access by the Buros-Nebraska Series on Measurement and Testing at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Teacher Training in Measurement and Assessment Skills by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Teachers' Assessment of Students: Roles, Responsibilities and Purpose Believing is Seeing

Donna Campbell

Arizona Education Association

Public education, and its assessment practices, have evolved from beliefs about how the world operates that are equivalent to the flat-earth theory. As long as the assessment of students is designed to fit obsolete "truths" about knowledge, learning, the mind, and human organizations, the roles and responsibilities of teachers in conducting such assessments, their purposes for doing so, and their preparation for fulfilling them will be likewise obsolete.

The following self-assessment (Figure 1) meets only one of fellow presenter H. D. Hoover's criteria for tests. It has not been checked for validity, reliability, objectivity, or fairness. It is, however, feasible. Thus, I invite you to examine some of your beliefs. Indicate the degree to which you agree or disagree with each of these statements.

I start with this examination of beliefs because neuroscientists tell us that believing is seeing. Their work expands the observations originally made by Kuhn in 1962 (Kuhn, 1970) that the paradigms governing scientists' work frequently prevent them from perceiving data that do not fit their particular structure of reality. What we believe about how the world works dictates what we are able to

Figure 1.

	Strongly Disagree			Strongly Agree		
1 We can understand things best when we break them down to their smallest component parts.	1	2	3	4	5	
2 Learning consists of the sequential accumulation of discrete facts and skills.	1	2	3	4	5	
3. Anarchy would reign if the staff and community of each school set their own goals for education and measured their attainment.	1	2	3	4	5	
4. To be valid and reliable, assessment instruments should be developed by specialists.	1	2	3	4	5	
5. Students should not be pressed to perform beyond their abilities.	1	2	3	4	5	

perceive in that world. Our beliefs, attitudes, and assumptions comprise our world view--the lenses through which we perceive and understand the world. William Barrett, describing the futility of the philosopher who professed to make a really fresh start in his discipline, points out, "Alas, he is found to carry in his intellectual baggage assumptions unsuspected by himself, as a consequence of which his data became selective and screened. He cannot see the glasses through which he is seeing" (1987, p. 36). And, what has this to do with the title of this chapter?

Teachers' lenses, or world view, inform their purpose in assessing students and that purpose dictates their roles and responsibilities. That purpose and its related roles and responsibilities are also focused by the world views of school administrators, boards of education, teacher educators, legislators, education department officials, researchers, test developers, and the public.

I intend to demonstrate how our beliefs define the current world of education and that corner of the education world we call "assessment." And how a different set of beliefs--or paradigm lenses--could reveal an entirely different world.

I will share a story told by psychologist Jean Houston (1982) to illustrate what I mean by a world view and by my theme "believing is seeing." She tells of a tribe in the Kalahari who believe that the world ends just beyond their local village boundaries.

It is reported that if you take them to that point, they will see nothing beyond it but a void. And if you tell them that you will prove to them that the world continues to exist beyond that point by stepping over the line of their so-called "world's end," they cry and beg you not to. If you persist in doing so, they are no longer able to see you and mourn your departure until you return across the line into the existing world. (p. 193)

This particular world view might be described as "magical." Nevertheless, what these African tribesmen believe about their world literally dictates what they are able to perceive in it.

James Burke, narrator of the PBS series "The Day the Universe Changed" (1987), asserted that we all do what these tribesmen do. We "alter reality to make it fit what [we've] decided it should be. Without a structure, a theory, for what's there, [we] don't see anything. [We] have to have some version of reality . . . For things to make sense, [we] have to make [our] mind up about them in advance."

Thus, our personal world views may constrain or expand our own sense of the boundaries of reality. Think for a minute about the kind of educational world that is created by the assumptions or theories that flow from an overarching belief that posits the nature of reality as mechanistic, reductionist, and deterministic. Component beliefs include the following:

- The mind is like a machine, taking in information from an objective, externalized environment, which functions on a linear time continuum.
- Intelligence is a static commodity which one either possesses or lacks.
- Learning occurs through the accretion of discrete, isolated bits of information and skills.
- The role of schools is to serve as a giant sieve for society, sorting and sifting its clients into their appropriate societal roles.
- Human enterprises operate most effectively when they are organized in a segmented, command-and-control hierarchy.

These beliefs are components of a world view and are illuminated by paradigms as Kuhn (1977) defines them:

Paradigms are not to be entirely equated with theories. Most fundamentally, they are accepted concrete examples of scientific achievement, actual problem solutions which scientists study with care and upon which they model their own work. If the notion of paradigm can be useful to the art historian, it will be pictures not

styles that serve as paradigms Both "style" and "theory" are terms used when describing a group of works which are recognizably similar. (p. 351)

Thus, paradigms in education appear to include the following:

- Horace Mann's common school, consisting of a teacher-lecturer, supervised seatwork, and textbooks--all designed to control information.
- Charles Eliot's 20th century curriculum consisting of new classifications of knowledge, clock hours, and Carnegie units.
- Conant's consolidated schools, a combining of small, independent educational units into larger and segmented organizational hierarchies.
- Binet's test of intellectual capacity.

The theories from which these paradigms emerged were "chosen" in a similar way to how scientific theories are "chosen" according to Kuhn (1977); that is, on the basis of both objective and subjective, or individually idiosyncratic, criteria or values. The latter flow from personality and biography, both forged in the cultural crucible of the individual's time. *The same crucible forges the so-called objective criteria.* Overarching beliefs about how the world works and the values attributed to those beliefs are embedded in the cultural environment and give rise to the criteria by which information is judged, to the lenses through which information itself is perceived, and to the models or paradigms that are emblematic of aspects of those beliefs.

HYPOTHETICAL MECHANISTIC-REDUCTIONIST SCHOOLS AND PRACTICES

If we believe that the world is ultimately knowable by reducing it to its smallest components and that those components are the equivalents to the parts of a machine, what kind of schools and practices could we expect to emerge? We would probably see knowledge divided and subdivided into atomistic bits of information and skills, arranged by subjects that are kept separate by departmental structures, textbooks, allotted minutes per day, and closed classroom doors. The curriculum would be arranged like a string of pearls, described in detailed scope-and-sequence documents. Students would be classified by age categories and distinguishing labels such as gifted, learning disabled, emotionally handicapped, trainable

mentally handicapped, educable mentally handicapped, overachiever, underachiever.

Passage of students, or "raw materials," through such a system would be akin to the progress of a car down the assembly line, manufacture occurring bit by bit. Instruction would consist of "batch processing" via frontal teaching and direct instruction. Teaching effectiveness would be judged against a checklist of enumerated behaviors based on a standard teaching model in which teachers had been trained.

In such a system, teachers would be seen as skilled assembly line workers following orders from their foreman-principal who is following orders from central office administrators who are following orders from the board of directors which is complying with state and federal orders. These line-workers would perform their work in isolation, neither helping nor being helped by others, each order-taker resenting and blaming the perceived order-giver.

And, if the school was not operating up to par, what might we see? We would not be surprised to see new equipment and technology brought into the "plant" to increase efficiency. Nor would there be surprise in viewing the influx of additional personnel--more specialists to deal with increasingly refined categories of students, subdivisions of knowledge and educational programs; more supervisors to handle ever more specialized educational functions and to oversee instructors who they see as Henry Ford saw his "average worker, want[ing] a job in which he does not have to think" (Clancy, 1989, p. 196).

HYPOTHETICAL MECHANISTIC-REDUCTIONIST ASSESSMENT

And what of assessment in a school that looks like this--a school that is designed to fulfill theories about intelligence as static, learning as simple accretion, the mind as machine, organizations as command-and-control hierarchies? It would undoubtedly be designed to fulfill the school's belief that its purpose is to prepare students for adult life by sorting and grading and labeling them as they are processed from raw material to finished product. A hard-headed "scientific" approach to testing would be employed that promised prediction and control. To legitimate its sorting process, the school would become increasingly dependent on the "certainty" that the mathematics of statistics brought to its judgments about students. As Barrett (1987) reminds us, "there is a certain type of mind that prefers exactness, or what looks like exactness, to adequacy" (p. 44).

We would probably see written and oral questions that seek the recall of atomistic bits of information and tests that check the acquisition of discrete skills. Formal and informal assessments would be devised to pit student against student so that their learning could be compared on a competitive basis, educational gates could be opened or closed to them, a rank-ordered value could be ascribed to each one, and their identification as "above average" or "below average" could be ascertained.

As public schools became more segmented and specialized and the desire to categorize students became more paramount, experts would be more heavily relied upon to devise quality control assessments that checked how many pearls were strung by each student as well as the strength of the student's string itself. These experts would perform their work for textbook publishers, state departments of education, school district central offices, universities, and commercial test companies. Cost containment concerns could be expected to limit the format of their expertly constructed assessments to a fill-in-the-bubble, machine-scorable one. Of course, the use of technology by such experts could allow them to establish data banks of test questions that might be accessed in a somewhat wider variety of formats by teachers. The common denominator of all such tests would be the presence of only one right answer for any item.

In such a mechanistic, reductionist world of education and assessment, the teachers' *purpose* in assessing students would be to determine the place for each student and then keep him/her in it. Their *roles* would be those of middle-man--delivering others' assessments to their students and returning completed forms to others for scoring and interpretation--mimics of their own teachers' and professors' assessment behaviors, and deterministic prophets of their students' success in school, based in large part on the information they gather while playing these other two roles. Their *responsibility*? To obey the directions of their "betters," their supervisors, the authors of teacher-proof textbooks, and assessment experts.

REAL SCHOOLS

Real schools in America bear a remarkable resemblance to those that were hypothetically modeled on the deterministic, mechanistic, reductionist world view of classical science. These real schools serve age-segmented clients who, for the most part, are treated as passive recipients of "lockstep applications of skill hierarchies and spiraled curriculum" (Marzano, 1988, p. 17). Identified at ever earlier ages as

"at-risk" or "gifted" or "developmentally slow" or as whatever the educational label-of-the-month might be, students are measured for their "fit" with the common curriculum and slotted into categories of bureaucratic convenience. "Where formerly classroom teachers tried to accommodate students' diverse needs, . . . [they now] simply seek referrals to special programs for those students who do not fit the curriculum" (Keating & Oakes, 1988, p. 10).

And, regardless of which category they are in, most students can expect the mind-numbing, repetitive, educational rite of passage embodied in drill-and-practice of discrete, decontextualized subskills in a progression from easy to difficult--practicing over and over and over again what they do not master quickly and over again what they do. "[T]he curriculum and instructional strategies that are common across all tracks are often mediocre even for average and above-average students Telling and lecturing, along with monitoring seat work, dominate classroom teaching" (Keating & Oakes, 1988, p. 9).

Although today's instructional practices have their roots in the lecture and seat work methods devised by Horace Mann in the 1830s to meet Massachusetts industrialists' needs for a compliant work force, the "modern" high school curriculum, towards which the elementary and middle school curricula now spiral, was defined at the turn of the century by NEA's Committee of Ten, chaired by Harvard President Charles Eliot. Arguing at the time that the 19th century curriculum of Latin, classical literature, rhetoric, natural philosophy, and natural history was irrelevant to the 20th century, this group recommended instead 4 years of English, 3 of social science, and 2 each of mathematics, science, and foreign language (Hutchins, 1988). Mimicking the high school division of knowledge into discrete categories, the elementary classroom lacks only the Pavlovian bell and its teachers the department chair status and extra pay of their secondary counterparts. Young students who enjoy playing "teacher," like I did as a child, can duplicate their own teacher's schedule of lessons with great accuracy after a few weeks in a particular classroom: each subject treated separately in sequence for the same number of minutes each day with occasional variations for science, art, music, and physical education.

Breaking curriculum, seen as classroom routines, into small steps and teaching the steps, and managing smooth transitions from one subject to another are two hallmarks of what has come to be known as "effective teaching." Additional elements of this paradigm, which is based on research with a scope that applies primarily to elementary grade students in low SES schools for their acquisition of basic skills

as measured by standardized tests, include direct instruction of the entire class and assigning tasks with simple unambiguous demands (Edelsky & Harman, 1987).

Madeline Hunter epitomizes this behavioristic, cause-effect approach to teaching and personifies teacher-as-authority-figure, as well as conveying submission to the mega-authority of science, when she stands before her educator audiences, clad in a white lab coat while presenting her seven-step method of teaching. Although she calls her formula a model for teacher decision making and claims that it is not intended for summative evaluation of teacher performance, 44 out of 48 states surveyed by *Democratic Schools* in 1988 reported using Hunter and Hunter-type models as a teacher evaluation tool (DiBernardo & Stiles, 1988). Having been exposed to the Essential Elements of Instruction (EEI) through inservice sessions that are frequently mandatory, teachers are expected to use immediately every element in every lesson. Even when teachers' instruction in EEI is accompanied by technical coaching, that process itself "fits excellently into an educational system which is becoming ever more inclined to bureaucratic forms of control over its employees in order to secure the implementation of centrally determined, standardized forms of 'effective' instruction" (Hargraves & Dawe, 1989). The standardized curriculum and standardized school day are now joined by standardized teaching practice--practice that is not linked by research to improved student learning (Slavin, 1987).

Thus "Hunterized," teachers return to isolated classrooms, which comprise the lowest level of the educational hierarchy, once again having been the captive recipients of an expert's knowledge and once again themselves becoming the expert dispensers of knowledge to their captive recipients.

The hierarchical, inflexible, top-down management structure of the entire educational system resembles a set of nested boxes. As policy makers at the federal and state levels mandate educational programs, procedures, and now, goals and the tests by which to measure them, school district decision makers, modeling their enterprise on Industrial Age corporate structures, mimic the contextual hierarchy in their organizations. Schools, like little factories, are characterized by lock-step learning, chopped up in discrete blocks of time and narrow notions of performance, and, like factories, turn out recognizable similar "products" over time (Keating & Oakes, 1988). Within the next nested box, teachers mechanically replicate the authoritarian hierarchy. Hutchins (1987) sees this phenomenon related to rigid evaluation models of teaching.

...the trend to mechanistic models of teaching seems to have been accompanied by a subtle shift in the responsibility for learning from the student to the teacher. As teaching becomes more and more a matter of "step 1, step 2, step 3, etc.," the instructor becomes more and more controlling in the learning situation. The practice of using models tends to degenerate easily into saying, in effect, "Students, just follow my instructions and you will learn what I want you to learn." (pp. 17-18)

Physically separated from their co-workers by the walls and closed doors of classrooms and professionally separated from the wisdom of their peers by sink-or-swim induction and operational norms, teachers try to establish a beachhead of control with their students. In such an environment, "where there are only crumbs to share," Ann Lieberman (1988) finds that "teachers tend to hide their successes as well as their failures. Each teacher looks out for his or her own welfare . . . [amid] the powerful infantilizing effects of the school." (p. 651)

In this "sage-and-fools caste system . . . [teachers'] present roles as classroom masters are more like wardens, more concerned with keeping their charges in line than with enabling them to live more fully" (Litvak & Senzee, 1986, p. 176). And, within such a system, the last nested hierarchical box is the brain itself, where educational practices lead to a dominance of the logical, analytical, step-by-step modes associated with the left hemisphere of the brain over the integrative, synthetical, and holistic modes of the right (Russell, 1983).

REAL ASSESSMENT

The actual assessment of students in our schools today resembles in almost every detail the hypothetical approaches proposed as derivatives of the mechanistic-reductionistic world view. Whether it is conducted formally or informally, student assessment is congruent with the educational structures and practices found in our schools.

Formal assessment of student achievement through the use of tests that were developed external to the school took root after World War I (Ornstein & Erlich, 1989), coinciding with the movement at the end of the 19th century, observed by Timar and Kirp (1988), away from an appreciation of education for its intrinsic value towards an appreciation of it for what it could do, its instrumental value.

At various times over the past eighty years, education has been regarded as creating social and political harmony by integrating

immigrants into the mainstream of American life, as creating a more "efficient" society ordered along industrial forms, . . . and as helping to regain America's competitive edge in international economic markets. (Timar & Kirp, 1988, p. 46)

The emergent pragmatism of education found a happy marriage with the utility of the large-group administered and easily scored tests devised by Alfred Binet to determine the capacities of different children for schooling and modified for use by the Army in World War I as a quick measure of soldiers' capabilities. Their scores on such tests became the primary determinant of their assignments. "Group administration of tests (a wartime necessity) and the strong reliance on the test score as the measure of 'intelligence' *remained the norm even after the war ended*" (Ornstein & Erlich, 1989, p. 109).

That intelligence and, later, achievement were thought to be reducible to a numerical score helped serve the instrumental purpose of education--one's "number" determines one's appropriate place in the clockwork universe--while reaffirming the belief that complex phenomena, such as human potential, could be understood best by breaking it down to its basic building blocks, an intelligence quotient, or an achievement score. Predicting academic success, the original purpose of such tests, has tended to determine academic success. As Keating and Oakes (1988) point out:

Popular views about intelligence and ability, as well as perceptions about the distribution of talent in the general population, influence educational practice. What seems fair and reasonable at the moment--tests showing how students compare with others on global characteristics such as mathematics and verbal aptitude--turns out systematically to limit some students' access to knowledge. For the most part, tests of intelligence, ability and achievement simply rank students, separating and segregating them and sorting them for future social participation Once the tests identify and legitimize students' differences, students are provided with different school experiences. (p. 7)

In addition to their predictive uses, assessments of student achievement in the form of norm-referenced tests, criterion-referenced tests, and minimum-competency tests are also being used to gauge the success of schools themselves. In his presentation at the 1985 ETS Invitational Conference, TheodoreSizer attributed this accountability drive to "The public (or, more accurately, that minority of the public that has political awareness and clout) want[ing] to see evidence that its educational investment yields demonstrable returns" (p. 2).

Formal assessment of student achievement is a growth industry. The National Governors' Association (1988) reports that in 1985 alone,

27 states adopted 37 new testing programs, supporting the contention of Dorr-Bremme and Herman (1986) that "educational testing is a pervasive enterprise . . . in which hundreds of millions of dollars in public monies are expended annually [and in which] significant teacher and student time is spent, representing fully half of the testing at the elementary school level and one-quarter of the total student testing time at the secondary level" (pp. 2, 18). Calfee and Hiebert (1987) decry the absence of programs to enhance teachers' skills in assessment as parallels to the burgeoning assessment programs mandated nationally and at the state level, concluding that because the state and national data bases of these programs make no provision for the judgments of classroom teachers, classroom assessments are not viewed as a sound base for policy making. Former Education Editor of the *New York Times*, Fred Hechinger (1989), opines that policy makers lack confidence in teachers. "If you trusted the teacher, you would say, 'This teacher can tell me how well this child does.' Since we don't have that trust, we superimpose the tests" (Hechinger, 1989, p. 4).

Although policy makers seem to distrust teachers' assessments of student achievement, perhaps believing that they lack objectivity--a quality greatly valued by those operating within the mechanistic-reductionist world view, they appear to be unquestioning consumers of "standardized tests [that] are consistently sold as scientifically developed instruments that objectively, simply, and reliably measure students' achievement, abilities, or skills" (Neill & Medina, 1989, p. 689). Teachers themselves, although critical of standardized tests (Dorr-Bremme and Herman [1986]) in their 5-year study of test use found that teachers believed the tests were not a good measure of what they had taught and that they had a better, more specific idea of students' strengths and weaknesses), "proceed to test in predictable ways, often modeling their approaches on the externally developed examinations they see most often, the standardized achievement test. Or they simply use the tests included in the textbooks" (Atkin, Patrick, & Kennedy, 1989, p. 76).

PREPARATION OF TEACHERS

This conference poses the question, "Are our school teachers adequately trained in measurement and assessment skills." Given the current structure of our schools and the beliefs on which they are based, I must answer "yes" to this query. Teachers are exposed to little or no information on measurement and assessment in their

preparation because they are not the people in the education system who are expected or trusted to perform valued measurement or assessment. They receive as much training in this as the system will allow them to actually use.

Other chapters in this volume suggest that few teacher education programs require or offer coursework in student assessment. There seems to be little need to do so if it is experts within or outside of the public school system upon whom we are going to rely to perform the only valued performance of this function. I interpret the absence of such training as a revelation of the attitude that "Whatever you do to assess students in your classroom is okay, because it does not really count anyway."

We have been told that when college coursework does include measurement and assessment, it tends to concentrate on statistics as a form of esoterica, knowledge to be grasped by only the chosen few who are far removed from the hurly-burly of the public school classroom. I interpret this training emphasis as manifesting an attitude that says in effect, "We, the Ed. Psych. gurus of tests and measurement, know what's best for you. Because most of you won't even fathom this, please trust us and our fellow experts to provide you the only credible assessment tools you'll need once you reach the classroom. Go forth to sort and label, delivering our tests, imitating our guru-like demeanor, and following our directions." Calfee and Hiebert (1987) describe this role of teachers, for which they are groomed by preservice preparation and the school workplace, as "meter reader" (p. 45).

THE OLD LENSES

Our schools and attendant assessment practices "make sense" when seen as grounded in the mechanistic-reductionist world view. It is our beliefs that provide versions of reality, James Burke instructs us:

For things to make sense, you have to make up your mind about them in advance; otherwise you wouldn't know where you are. . . . The only structure in the shifting, changing face of nature is the one we impose on it with our theories, each one the latest version of what we call the truth. (Burke, 1987)

If we believe that the world ends here, then that is where we see the end of the world. If we believe that the nature of the world is analogous to a machine and can be understood when broken down to

its smallest component parts, then we derive understandings about the mind, intelligence, learning, and organizations that are consistent with that world view, and create enterprises that fit it. And, we see what we believe.

Physicist Fritoj Capra (1982) describes the traditional scientific view of the world, the one on which our schools are based, in this way:

Matter was thought to be the basis of all existence and the material world was seen as a multitude of separate objects assembled into a huge machine Consequently, it was believed that complex phenomena could always be understood by reducing them to their basic building blocks This attitude, known as "reductionist," has become so deeply ingrained in our culture that it has often been identified with the scientific method. The other sciences accepted the mechanistic and reductionist views of classical physics as the correct description of reality and modeled their own theories accordingly. Whenever psychologists, sociologists, economists wanted to be scientific, they naturally turned toward the basic concepts of Newtonian physics. (p. 23)

Bela Banathy, general systems scientist, invites educators to consider the traditional scientific paradigms, dating from the 17th century, as we attempt to redesign the educational system:

Inspired by the Cartesian-Newtonian scientific world view, disciplined inquiry during the last three hundred years sought understanding by taking things apart, seeking the "ultimate" part, and groping to see the whole by viewing the characteristics of its parts. Implicit in this approach is an exclusive commitment to defining elementary cause and effect relationships, which led to a deterministic perception of the world. The outcome of these perspectives was best manifested in the Industrial Revolution, and its essential characteristics were derived from analytic thinking, reductionism, and determinism. (Banathy, 1988, p. 52)

Comfort with the belief that one knows (or can know) what causes things to happen and that the same conditions always produce the same results is typical of Second Wave thinking, Toffler (1981) tells us, and conjures up an image of the entire universe as consisting of "cue sticks and billiard balls--causes and effects" (pp. 303-304).

Embedded in the reductionistic, mechanical, and deterministic components of the Newtonian-Cartesian world view, is the related belief that change is incremental, occurring linearly. Believing thus, how could we see the mind as anything but a machine, learning as anything but cumulative, assessment as anything but a sorting and labeling process, and schools as anything but segmented hierarchies?

It was adherence to this Newtonian world view that guided the work of psychologists in the first half of this century which, according to Hampel and Farnham-Diggory, forms the basis of our present school system.

The ideas of Thorndike, Skinner, Gagne, Bloom and others shaped the organization of the school day, curricular materials, grading practices, and testing . . . Thorndike and other viewed knowledge as modestly analogous to a string of pearls. Learning was the activity of stringing the pearls . . . Curricula today are still largely based on the assumption that knowledge can be added to previous knowledge in a purely cumulative fashion. This is particularly evident wherever teachers are required to set so-called behavioral objectives for their pupils. Any plausible objective will do, as long as it can be counted, as long as students can spell eight out of ten words on list A. (Hampel & Farnham-Diggory, 1987, pp. 7-9)

Schools seem to have embraced the same "overly reductionistic, materialistic, and mechanistic" old-physics belief system that Litvak and Senzee (1986) accuse biology of emulating by "attempting to reduce biological phenomena to elementary bits and pieces. Many biologists today do not consider a biological phenomenon real unless it is reducible to an explanation from physics. Thus everything in the living world is reduced to machinery--all living things are 'nothing but' passive automata manipulated by the environment" (pp. 48-49). The irony is that the very world-view lenses of the old physics that are now worn by most biologists and educators, "reductionism based upon the mechanistic model of physics" (p. 49), has actually been rejected by the physicists themselves.

THE NEW LENSES

Just as earlier beliefs, "versions of the truth" (e.g., the earth is the center of the universe, the earth is flat, evil exists in the form of witches and burning them at the stake is an act of mercy, man is not meant to fly, children with Down's Syndrome should routinely be institutionalized), worked perfectly well for a while, they eventually gave way to a new structure of reality. Kuhn (1970) describes this "giving way" of the paradigms governing science as following a predictable sequence: Prevailing images encountered anomalies. Uncertainty paved the way for competing images. Competition among paradigms held sway until one prevailed.

Jarman and Land (1989) summarize a paradigm shift in science that continues to reverberate:

Soon after the turn of the century, scientists ran smack into a collection of discoveries and facts about nature that forced them to totally revise their definition of reality Einstein's discoveries completely redefined reality. [His and] a host of other pioneering ideas confirmed that the real world is based on entirely different principles than had been known or even suspected before this century. We are only just now beginning to recognize the almost incredible impact of those discoveries No one was offended more than these pioneering scientists themselves when their own discoveries and tests showed that the great body of ancient, logical and reasonable ideas of science was in error. The logical "natural order of things," long thought to be the basis of nature, just did not fit the torrent of emerging facts. (pp. 39, 44)

Einstein showed that time and space were not absolute and fixed, but relative. Not only were time and space one but so were the electric and magnetic forces, and energy and matter (Russell, 1983). The discovery that "matter" is in fact bound energy revealed that everything in the universe exists in two very different and simultaneous states, as both particles and waves, as both something solid and invisible at the same time. "The world and everything in it, exists in two simultaneous and factual states: 'being'--the physical, material state--and 'becoming'--the invisible waves of possibility and probability surrounding it" (Jarman & Land, 1989, pp. 47, 50).

Einstein's Theory of Relativity was followed by Quantum Theory: the behavior of subatomic particles appears random in nature. Einstein could not accept this paradigm shift, clinging to his deterministic lenses when he exclaimed, "God does not play dice with the universe!" and believed he had proved its discoverer, Max Planck, wrong with his Einstein-Podolsky-Rosen Effect (EPR Effect). However, nearly 50 years later, physicist J. S. Bell validated quantum mechanics with a test based on the EPR challenge and discovered that change in one particle which was smaller than an atom and moving at a velocity near the speed of light, simultaneously affected the other particle with which it had been paired. Its far-reaching implication: Everything in the universe is intimately connected without regard for the distance between any two objects (Travis & Callendar, 1990, p. 55).

Might it be this new version of the truth that provides the context for Heisenberg's Uncertainty Principle? It contends "that it is impossible to objectively measure anything [because] the measuring device always interferes by forming a relationship with the subject that alters how the event in question would have turned out if no measurement had been taken" (Travis & Callendar, 1990, p. B-6). Heisenberg's demonstration that the act of observation itself affects that which is

being observed had shattering implications for physicists of the time who regarded the observer and the observed as separate detached entities. "Somehow the mental and physical worlds were interdependent" (Russell, 1983, p. 141).

British physicist David Bohm offers one approach to understanding this interconnectedness with his notion of implicate order, or enfolded order, from which the explicate order, the universe we see around us, unfolds and into which it enfolds, simultaneously. The image of a hologram serves as a metaphor for implicate order. When even one part of a holographic plate is illuminated, an image of the whole object is still obtained (Bohm & Peat, 1987). This analogy suggests that each part of the physical universe--you, I, a tree, etc.--like the hologram, has the whole of time and space encoded in every part of it, containing all the information about the whole universe within it.

Jarman and Land (1992) conclude from these discoveries that "the ancient notion that all things are separate is factually wrong. Everybody and everything is connected. Everything affects everything else. No matter how different, no matter how far away, we are all part of one another" (p. 56).

Although the paradigms of relativity and quantum mechanics undermined the old paradigms of mechanical materialism and reductionistic separateness, their assumptions of randomness are being challenged by the theory of dissipative structures posited by Ilya Prigogine and by emergent chaos theory. Prigogine won the 1977 Nobel prize in chemistry for his study of the transformation of randomness into order, or the emergence of order from chaos. His *Theory of Dissipative Structures* proposes that inherent in the nature of any system is its attempt to stabilize itself in the midst of stress from the outside. If the stress becomes too great, the system may collapse. Alternatively, if the system survives this period of chaos, reorganization at a higher level of complexity and a new level of stability can emerge. Furthermore, the new is totally unpredictable if all we look at is the structure of the old (Travis & Callendar, 1990).

The past, thus, does not predict or cause the future, nor does constant change point to the devolution of molecular disorder. Rather, "Change is driven by the pull of the future to connect everything at broader, deeper, more interpenetrating levels Our world is progressing inevitably toward more complex interrelatedness and connectedness" (Jarman & Land, 1992, pp. 60-61).

Chronicler of chaos theory, James Gleick, reports on the scientific community's latest revolution which deals with the concept that from

seemingly chaotic behavior, regular but unpredictable patterns emerge. “John Hubbard . . . considered chaos a poor name for his work, because it implied randomness. To him, the overriding message was that simple processes in nature could produce magnificent edifices of complexity *without* randomness” (Gleick, 1987, p. 306). Furthermore, although the original investigators of chaos, who came from multiple scientific and mathematical specialties, expected their studies to support their tacit beliefs about complexity--that simple systems behave in simple ways, that complex behavior implies complex causes, and that different systems behave differently--they learned instead: “Simple systems give rise to complex behavior. Complex systems give rise to simple behavior. And most important, the laws of complexity hold universally, caring not at all for the details of a systems’ constituent atoms” (Gleick, 1987, p. 304).

As the new science of chaos itself arose from simultaneous inquiries by scientists in the fields of meteorology, mathematics, biology, physics, and astronomy, more and more of the investigators “felt the compartmentalization of science as an impediment to their work. More and more felt the futility of studying parts in isolation from the whole. For them, chaos was the end of the reductionist program in science” (Gleick, 1987, p. 304). Likewise, it marked the end of the either/or thinking of determinism *or* free will and the beginning of a marriage that wed determinism *and* free will (Gleick, 1987, p. 304).

WHEN WORLD VIEWS COLLIDE

A comparison of the basic beliefs comprising classical science with those of new science is shown in Figure 2.

Figure 2.

New Science Creative World View	Classical Science Causal World View
<ul style="list-style-type: none">• Change is probabilistic, occurring through a perpetual creative and transforming process of being and becoming.• All things are connected-at all times and instantaneously at any distance.• Change is driven by the pull of the future to connect everything at broader, deeper, more interpenetrating levels.	<ul style="list-style-type: none">• Change is a step-by-step incremental process.• All things are separate, existing independent of each other and their environment.• Events are driven by and are a result of past causes; the present is determined by the past.

(Jarmin & Land, 1992, pp. 37-65)

The emerging paradigm in "physics, psychology, and progressive biological circles," according to Litvak and Senzee (1986) "is that a comprehensive (or holistic) perspective must be adopted in place of mere mechanistic reductionism" (p. 49). Banathy (1988) characterizes the new scientific paradigm as "a major shift toward synthesis, expansionism, indeterminism, emergence, and a systemic-ecological world view" (p. 53). And Toffler (1981) describes the collision of this new world view with the entrenched paradigms of industrial society as "the beginnings of a philosophical revolt aimed at overthrowing the reigning assumptions of the past 300 years" (p. 289).

Kuhn (1970) calls such paradigm-induced changes in scientific perception "transformations of vision" (p. 118). A paradigm shift is not gradual, but a Gestalt shift—one must see it one way or the other. Proofs and logic are *not* the currency of exchange between conflicting paradigms. The irrelevance of one another's arguments to adherents of competing paradigms has been labeled by Kuhn as "incommensurability." "Communication across the revolutionary divide is inevitably partial. . . . before they can hope to communicate fully, one group or the other must experience the *conversion* [emphasis added] that we have been calling a paradigm shift The transfer of allegiance from paradigm to paradigm is a conversion experience that cannot be forced" (Kuhn, 1970, pp. 148-151).

Max Planck (as quoted by Kuhn, 1970) reflected on this in his autobiography:

A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it. (p. 151)

BLIND SPOTS

Why don't scientists see data that they don't expect to see? Why don't many of us in education see the relationship of scientific breakthroughs to our own enterprise or see that our current paradigms limit human growth? I propose that the world-view lenses through which we perceive are by their very nature equipped with a blind spot that is analogous to the physical blind spot in the eye itself. Ornstein and Erlich (1989) point out that there are no photoreceptor cells where the optic nerve exits the retina, so this part of the retina cannot respond to light. "When the lens of the eye focuses an image of a small object on the blind spot, the image disappears. We don't notice the loss: our brain simply fills it in, using the context of the rest

of the picture. It is not that something that was there is now gone; we don't know that anything is missing" (p. 71).

Like the nested boxes of educational hierarchies, our blind spots are nested within one another. The world "out there" that we perceive is actually within us--in the design of the senses, the wiring of the nerve circuits, the processing of information in the brain, the interpreting of information (Ornstein & Erlich, 1989). So our physical blind spot is nested within an information-processing blind spot that is nested within an interpretive blind spot of attitudes, beliefs, paradigms, and world view. We don't see what we don't see. And, we don't see what we don't believe is worth seeing or is present to be seen.

"One particularly significant mechanism which the mind employs to defend itself against the inadequacy of its basic ideas," according to Bohm and Peat (1987), "is to deny that it is relevant to explore these ideas" or to go even further and to deny implicitly "that anything important is being denied" (pp. 22-23). Likewise, we don't see what we don't believe is related to our particular area of inquiry.

Another way of defending the subliminal structure of ideas is to overemphasize the separation between a particular problem and other areas But this only acts to prevent a clear awareness of the ultimate connections of the problem to its wider context and implications. The result is to produce artificial and excessively sharp divisions between different problems and to obscure their connections to wider fields. . . . by ignoring the connections of each thing to its whole context, the illusion can be created that the ideas, structures, and institutions that are the dearest can go on indefinitely and unchanged. (Bohm & Peat, 1987, pp. 23, 208)

As long as we peer through the lens of "all things, including people, are separate and apart," we will, for instance, deny that students and teachers should be dealt with as anything different from separate "particles" aligned within the hierarchy of a closed system. We will frame our problem as being one of how to better align those particles. Through those lenses we will also see schools as separate from their environment, thus seeking improvement efforts within the confines of the educational organization alone. Timar and Kirp (1988) describe this view as regarding "educational excellence as a series of discrete problems to be solved. The perspective is not broad . . . but narrow--on how to effect changes in specific areas of institutional life" (p. 120).

The more we argue for our blind spot, of course not knowing that it is blind, the blinder we become. "Rigidity," say Bohm and Peat (1987), "is ultimately the very source of this deterioration . . . because

all the proposed remedies are actually different forms of the same illness that they aim to cure" (p. 209).

But, vision is transformed. World view lenses do change. Paradigms do shift.

PRESCRIPTION LENSES INSTEAD OF WAR

Kuhn, Bohm, Peat, and Russell give us clues regarding the conditions necessary for improved sight. For instance, Kuhn (1970) describes crisis as a necessary precondition for the emergence of novel theories. He also suggests that, although proponents of different theories are like native speakers of different languages whose communication problems are compounded by their frequent use of the same vocabulary to represent completely different concepts, they can attempt to exhibit to one another the concrete technical results achievable by those who practice within each theory (Kuhn, 1977).

Bohm and Peat (1987) likewise hold out hope for something less destructive than a revolution to enable a change of world-view lenses to occur. They argue for allowing a plurality of basic concepts, with a constant movement of free creative play that is aimed at establishing unity between them. Exercising the creative intelligence that perceives new categories and new orders "between" the older ones--disjointed extremes--calls for, in their opinion, (a) self-awareness--revealing one's rigid assumptions to one's self, and (b) "dialogue"--communicating with an open mind and an open heart, desirous of understanding the other's point of view, ready to acknowledge any fact and any point of view as it actually is, and ready to change one's own point of view if there is a good reason to do so.

Altering one's world-view lenses may also consist of deliberately changing one's mind set, suggests Russell. He reports on the work of Dutch futurist Fred Polak, which reveals that in every instance of a flowering culture there has been a positive image of the future at work and that the intensity and energy of the images have been reliable predictors of the direction that cultures would take. Russell quotes Polak's conclusion: "Bold visionary thinking is in itself the prerequisite for effective social change" (Russell, 1983, p. 223).

IMPLICATIONS FOR EDUCATION'S PARADIGMS

Our education system, which has its roots in the Newtonian universe and *its* offspring, the Industrial Age, and which has survived for over 150 years by only modestly refining its essential components,

is under attack. Beleaguered by politicians, business leaders, and citizens, beset with internecine warfare, benumbed and numbing with classroom routines, schools seem to be encountering both the crises that precede the appearance of a novel theory and the rising disorder that is prelude to a shift in order--to either collapse or to a higher level of interrelated complexity.

Ainsworth-Land and Ainsworth-Land (1982) describe this process of evolutionary creativity, of divergence and convergence, in *Forward to Basics*:

In any system, once a relative orderliness has been achieved, the only means by which a broader and more complex interrelationship among the various elements can be achieved is by introducing or generating disorder. The system can come apart to be put together in a much more integrated way. Any system that resists this creative disintegration and re-integration can only suffer the gradual erosion of its established order due to the energy required to protect the system from change. (p. 79)

Banathy (1988) sees the efforts to change and improve education during the last two to three decades, because they flow from the piecemeal, fragmented, so-called scientific approach, as having the effect of protecting the system from change.

Nevertheless, as scientific thought is transformed by pioneers who ask novel questions and see anew, so is educational thought. By observing the pioneers in our midst, we may come to know the lenses through which they see the world of education and assessment, and thus take the first step toward a new order for education. Some of education's pathfinders today include the following:

- Indianapolis teachers who are creating an elementary school based on Howard Gardner's (1989) theory of multiple intelligences.
- Miami, Florida school policy makers who are situating schools at business sites throughout the community.
- Teachers, school support employees, administrators, students, and parents in Rochester, New York, Scottsdale, Arizona, Hammond, Indiana, Los Angeles, California, and growing numbers of other communities around the country, who are learning how to work together to make decisions about education.
- Educators at Prospect School in Vermont who are melding instruction and assessment with student portfolios and professional dialogue.

- Ted Sizer and his Brown University colleagues, consultant Grant Wiggins, and teachers, administrators, and students throughout the nation who are recreating high school education--its curriculum, instructional technologies, and assessments.
- Participants in NEA's 26 Mastery in Learning Project sites who are framing their own questions about teaching and learning and collaboratively creating their own answers through teacher-directed research.
- Johnson and Johnson at the University of Minnesota who are demonstrating the benefits to both students and teachers of working and learning cooperatively.
- St. Paul high schools that house health clinics.
- Harvard University's Project Zero staff, Educational Testing Service representatives, and Pittsburgh educators who are devising assessment systems that reflect students' growth in artistic achievement.

Whether each of these pioneers is aware of the Creative World View or not, each is acting in harmony with it. They are pulling themselves to their futures with their bold visions. They are pursuing their visions in relationship with others. They are in both a state of being and of becoming as they creatively change. Corollary beliefs of these paradigm makers seem to be:

- Learning is meaning-making, pattern discernment, creating.
- Organizations are vehicles for personal and collective empowerment.
- Intelligence is dynamic, multifaceted, and biased towards growth.
- Mind and body are one.

HYPOTHETICAL CREATIVE WORLD VIEW EDUCATION

I invite you to imagine the kind of educational enterprise we could create and the role that assessment would play in it if we, like our contemporary trail blazers, changed the lenses through which we view the world. Try on the lens that reveals all people in the educational organization mutually contributing to the growth of one another. Now, add the one that dissolves the boundary of the schoolhouse. Next, look through the lens that expands your range of vision to include participants of all ages and walks of life. And,

finally, slip into place the lens that discloses the magnificent creative energy of all those people.

With such lenses we might begin to see teachers, students, parents, and all of humanity as *capable*--regardless of their race or their economic standing or their age. We would probably see "schools" organized as true communities of mutual learning. We could perceive learning as involving real problems, intrinsically rewarding, empowering. And, we would see teaching transformed, synonymous with learning.

Although no new paradigms have securely replaced our current "flat earth" ones--Horace Mann's teacher as lecturer and controller of information and behavior, classroom as desks and texts confined within four walls, school as one social service agency among many serving a specific geographic area; Eliot's curriculum as a set of courses in which students serve time; Conant's school system as consolidated bureaucracy; or Binet's test--the pathfinders who have been mentioned provide us clues to the ones that may eventually hold sway. Descriptions of the emergent educational paradigms suffer from the same vocabulary problem cited by Kuhn about the clashes between new and old scientific paradigms: Proponents of each view use many of the same words--teacher, classroom, school, curriculum, administration, tests--but with conflicting definitions. Thus, their attempts at discussion of such incommensurable views appear to Clancy (1989) as "conversations of the deaf" (p. 201). Risking this, I offer new definitions inherent in the emerging paradigms.

Teacher: facilitator of learning, guide to potential learning resources, mentor, researcher, collaborative decision maker, coordinator of fellow educators who are of diverse ages--children through retirees--and backgrounds, diagnostician of thinking modes and patterns of growth, student of learning and of general systems, specialist in at least one method of disciplined inquiry whose unique contributions are designed to create synergy with fellow specialists.

Classroom: any physical location one chooses in which to consciously pursue learning, which is equipped with the human resources and technologies that are appropriate to the desired learning.

School: a community of learners, including teachers as defined above, who choose to come together for mutual growth and to serve as the fulcrum for human resource development services to their members and who organize their activities

around an explicitly shared world view whose assumptions are open to continual review.

Curriculum: a set of performance-based, holistic learning outcomes that is aligned with the school's world view and with an expanding knowledge base of human growth and development and which is accompanied by a regularly updated data base of sample learning resources and technologies that are known to contribute to the desired outcomes.

School System: an organization of schools, as defined above, whose decision makers choose to join together for the explicitly defined synergistic effects within their constituent communities of doing so.

And, in such learning communities, what would we see of assessment?

The *purpose of teachers' assessment* of students in schools aligned with this creative world view would be empowerment of both students and teachers. It would be designed to reveal students' methods for making sense of the world--their patterning styles; their "intelligences," to borrow Howard Gardner's term; their conceptions and misconceptions of various operations; and the degree to which they convey their integrated understandings through a variety of performances.

The *role of teachers* in fulfilling the purpose of such assessment would be as full partners in determining a shared vision for their school that includes holistic performance goals for students and plans for how to foster and evaluate student performance. Their role would also include full partnership with other educational specialists--researchers, test developers, for instance--and with their fellow learning community members--students, colleagues, parents, citizens--in the development and administration of assessment processes that were consistent with this world view and in the application of their findings from these assessments.

The *responsibility of teachers* for fulfilling such a purpose? To assume the authority of a full partner and accept the responsibility for exercising such authority.

PREPARATION OF TEACHERS

What kind of education of teachers is implied by the picture of education and assessment revealed through new world-view lenses?

Because my work entails the development of practicing teachers, I will focus on the concurrent courses of action that this tumultuous between-paradigms phase has engendered within the Arizona Education Association. We are engaged in the following efforts as we "convert" from one set of paradigms to another:

1. Encouraging bold new visions of education by creating such visions for our own organization through strategic planning and by providing resources to members that encourage them to examine their own world views of and assumptions about education. For instance, we've just produced a booklet on restructuring education in Arizona and are working with local association leaders on ways to make use of it in their districts and with their communities to commence the dialogue that must precede the development of new, shared visions of education. We are organizing viewings and discussions of Joel Barker's video on paradigms. And, we offer grants (Learning Improvement through Faculty Teams--LIFT--grants) to members who are undertaking leading edge transformations of teaching and learning.
2. Offering training in site-based decision making to members and to teacher-administrator audiences to assist them in functioning effectively as interactive work teams. The National Education Association has produced in-depth reference and training materials on this topic in consultation with experts in participatory management. Using these materials as a springboard, we also are creating experiential learning opportunities for people to hone their skills as facilitators of consensus decision making.
3. Forming alliances (or organizing at a higher level of complexity) with other groups to transform education. AEA has worked cooperatively with the state legislature to adopt broad goals for education in Arizona and with the state department of education to support and publicize a comprehensive new accountability system of multiple indicators to monitor progress towards those goals, that includes the assessment of student performance of complex problem-solving tasks. This, in turn, is leading to alliance-formation with subject-matter and professional education organizations and with higher education institutions to create the staff development opportunities that

teachers will need to align curriculum, instruction, and classroom organization with the new performance outcomes. Because the time required for staff development, collaborative decision making, and community-based dialogues about education depends on financial resources, AEA is also part of a coalition of educators, policy makers, parents, business leaders, and citizens that has secured 200,000 signatures to place a school funding initiative on Arizona's November 1990 ballot.

Perhaps these actions in Arizona, and similar ones around the country, will serve as an impetus to colleges and universities, to state education agencies, and to accreditation bodies, to revamp their own approaches to the education of teachers. Something will. Something must.

HOW TO BEGIN

John Goodlad reminds us that the future does not arrive full blown, but rather is defined by the small decisions we make each day. The new sciences of quantum mechanics and cognition reveal that every one of us is in the process of creating reality, that, in fact, "the possibilities we imagine for anything actually make up half of its reality" (Jarman & Land, 1992, p. 52) and the act of cognition does not simply mirror an objective reality "out there," but instead is an active process, rooted in our biological structure, by which we actually create our world of experience (Maturana & Varela, 1988). Thus, the most important action we each can take is to redefine our present idea of reality by exchanging our restrictive world-view lenses for those that expand and clarify our field of vision.

Redefining Our Present Idea of Reality. First, we must know what our present idea of reality is--what the power of our current world-view lenses is--and then how it defines our "edge of the world." That entails identifying our own beliefs, assumptions, and attitudes about how the world works and, thus, how education works. Three of the ways in which we can do so are the following:

- Be scrupulously honest with ourselves.
- Ask other people what blinds spots they perceive in us. (We can't see our own blind spots because we can't see what we can't see.)
- Analyze what it is we do see because our perceptions tell us what we believe. For instance, if I see teachers and

administrators "fighting over who's in charge," it reveals to me a belief that we are separate from each other, disconnected. If, however, I see teachers and administrators exhibiting that same behavior as "forming new relationships of greater complexity," it reveals my beliefs that all things and everyone is connected--at all times and instantaneously--and that disorder precedes the formation of connections at deeper, broader, more complex levels.

Next, we need to challenge, expand, and deepen our world view. Ways to do that include the following:

- reading, analyzing and comparing the familiar and the unfamiliar--professional literature and Greek philosophers, educational research and chaos theory, textbooks and electronic data bases;
- talking rigorously about familiar and unfamiliar ideas with people who are familiar and unfamiliar to us--a colleague and a nuclear physicist, a parent and a cognitive scientist, a student and a musical composer, a family member and a top-performing athlete; and
- conducting our own comparative research on the familiar and the unfamiliar.

Third, we have the responsibility of helping all education stakeholders to expand their world view, as well. It is only when we have all exchanged our Ben Franklin spectacles for lenses that allow us to see much broader horizons, that we will have completed the action of redefining our sense of reality and be capable of creating a new reality for education.

Creating A New Educational Reality. Based on a world view that is more closely aligned with what is known about the current scientific facts of life and about perception, cognition, and human development, we then must ask ourselves and fellow stakeholders two questions: "What purpose do we want education to serve in this community?" and "What do we want students to know and be able to do as a result of participation in this education process?" This constitutes the vision creation process--President Bush's "vision thing."

Next, as Stanford Professor Larry Cuban (1989) suggests, we must ask, "What should we do to help students reach these ends?" Answering this query will involve looking at how to organize the enterprise of learning, how to structure curriculum, how to employ instruction, how to use time as a resource, and how to assess and build on students' learning strengths.

Only then are we ready to ask the accountability-related question, "How will we know that we're fulfilling our school's purpose and that students are reaching the desired ends?" The kind of accountability system developed in response to this will be one that allows the educational enterprise--the "Ship of Schools"--to self-correct the course of its voyage because finally it knows where it is, where it is going, and is powering itself to its future, its new reality.

Who Should Begin? Any one person can begin. As the scientists studying the new field of chaos tell us, a butterfly flapping its wings in China theoretically can affect the wind patterns in New York City. And, as Jarman and Land (1992) convey the findings of research on major social changes, "Five per cent of a population needs to change before the established leaders begin to take notice that something new is happening. Once that intrepid 5% convinces another 15%, then a rapid and unstoppable momentum shifts the other 80%" (p. 68).

I invite you to return to the quiz about your beliefs with which I began this presentation and to keep in mind this ancient Sufi parable reported by Maturana and Varela (1988) in their exploration of the biological roots of human understanding:

A story is told of an island somewhere and its inhabitants. The people longed to move to another land where they could have a healthier and better life. The problem was that the practical arts of swimming and sailing had never been developed--or may have been lost long before. For that reason, there were some people who simply refused to think of alternatives to life on the island, whereas others intended to seek a solution to their problems locally, without any thought of crossing the waters. From time to time, some islanders reinvented the arts of swimming and sailing. Also from time to time a student would come up to them, and the following exchange would take place:

"I want to swim to another land."

"For that you have to learn how to swim. Are you ready to learn?"

"Yes, but I want to take with me my ton of cabbages."

"What cabbages?"

"The food I'll need on the other side or wherever it is."

"But what if there's food on the other side?"

"I don't know what you mean. I'm not sure. I have to bring my cabbages with me."

"But you won't be able to swim with a ton of cabbages. It's too much weight."

"Then I can't learn how to swim. You call my cabbages weight. I call them my basic food."

"Suppose this were an allegory and, instead of talking about cabbages we talked about fixed ideas, presuppositions, or certainties?"

"Hummm . . . I'm going to bring my cabbages to someone who understands my needs." (pp. 249-250)

Are we willing to let go of the ideas that weigh us down and that blind us? Believing is seeing. Act as though you believe one person can make a difference. Act as though you can create a new reality for education. And watch reality shift. See it happen before your eyes.

REFERENCES

- Ainsworth-Land, G., & Ainsworth-Land, V. (1982). *Forward to basics*. Buffalo, NY: D.O.K. Publishers.
- Atkin, J. M., Patrick, C. L., & Kennedy, D. (1989). *Inside schools: A collaborative view*. New York: The Falmer Press.
- Banathy, B. H. (1988). An outside-in approach to design inquiry in education. In *The redesign of education: A collection of papers concerned with comprehensive educational reform* (pp. 51-71). San Francisco: Far West Laboratory.
- Barrett, W. (1987). *Death of the soul*. Garden City, NY: Anchor Press.
- Bohm, D., & Peat, F. D. (1987). *Science, order, and creativity*. New York: Bantam Books.
- Burke, J. (1987). *The day the universe changed: Worlds without end* [Video]. London: British Broadcasting Corp.
- Calfee, R., & Hiebert, E. (1987). The teacher's role in using assessment to improve learning. In E. E. Freeman (Ed.), *Assessment in the service of learning: Proceedings of the 1987 ETS invitational conference* (pp. 45-61). Princeton, NJ: Educational Testing Service.
- Capra, F. (1982). *The turning point: Science, society, and the rising culture*. New York: Bantam Books.
- Clancy, J. J. (1989). *The invisible powers: The language of business*. Lexington, MA: Lexington Books.
- Cuban, L. (1989, October). *First and second order change in education*. Presentation made at the annual National Education Association meeting of state affiliate directors of instruction and professional development, San Diego, CA.
- DiBernardo, G., & Stiles, D. (1988, Spring). The Madeline Hunter and Lee Canter teacher improvement packages: What every school needs? *Democratic Schools*, pp. 1-9.

- Dorr-Bremme, D., & Herman, J. L. (1986). Assessing student achievement: A profile of classroom practices. *CSE Monograph Series in Evaluation*, (Whole No. 11, pp. 2, 18).
- Edelsky, C., & Harman, S. (1987). *One more critique of testing--with two differences*. (Available from Center for Establishing Dialogue, 325 E. Southern Ave., Tempe, AZ 85282)
- Gardner, H. (1989). *To open minds*. New York: Basic Books.
- Gleick, J. (1987). *Chaos: Making a new science*. New York: Penguin Books.
- Hampel, R. L., & Farnham-Diggory, S. (1987, October). Restraining the pearls. *Basic Education*, 32, 7-9.
- Hargraves, A., & Dawe, R. (1989, March). *Coaching as unreflective practice: Contrived collegiality or collaborative culture?* Paper presented at the meeting of the American Educational Research Association, San Francisco.
- Hechinger, F. (1989, October). [Interview with Dorothy Massie, editor]. *Doubts and Certainties: Newsletter of the NEA Mastery in Learning Project*, 4(2), 1-5.
- Houston, J. (1982). *The possible human*. Los Angeles: J. P. Tarcher.
- Hutchins, C. L. (1987). Increasing your options: Models of instruction. *Noteworthy*. Denver: Mid-Continent Regional Education Laboratory.
- Hutchins, C. L. (1988). Design as the missing piece in education. In *The redesign of education: A collection of papers concerned with comprehensive educational reform* (pp. 47-49). San Francisco: Far West Laboratory.
- Jarman, B., & Land, G. (1992). *Breakpoint and beyond*. New York: Harper Business.
- Keating, P., & Oakes, J. (1988). *Access to knowledge: Breaking down school barriers to learning*. Denver: Education Commission of the States.
- Kuhn, T. (1970). *The structure of scientific revolutions* (2nd ed.). Chicago: The University of Chicago Press.
- Kuhn, T. (1977). *The essential tension*. Chicago: The University of Chicago Press.
- Lieberman, A. (1988, May). Teachers and principals: Turf, tension, and new tasks. *Phi Delta Kappan*, 69, 648-653.
- Litvak, S., & Senzee, A. W. (1986). *Toward a new brain*. Englewood Cliffs, NJ: Prentice-Hall.
- Marzano, R. J. (1988). *Dimensions of thinking: A framework for curriculum and instruction*. Alexandria, VA: Association for Supervision and Curriculum Development.

- Maturana, H. R., & Varela, F. J. (1988). *The tree of knowledge: The biological roots of human understanding*. Boston: New Science Library.
- Neill, D. M., & Medina, N. J. (1989, May). Standardized testing: Harmful to educational health. *Phi Delta Kappan*, 70, 688-697.
- Ornstein, R., & Erlich, P. (1989). *New world new mind: Moving toward conscious evolution*. New York: Doubleday.
- Results in Education 1988*. (1988). Washington, DC: National Governors' Association.
- Russell, P. (1983). *The global brain: Speculations on the evolutionary leap to planetary consciousness*. Los Angeles: J. P. Tarcher.
- Sizer, T. (1985). Changing schools and testing: An uneasy proposal. In E. E. Freeman (Ed.), *The redesign of testing for the 21st century: Proceedings of the 1985 ETS invitational conference* (pp. 1-7). Princeton, NJ: Educational Testing Service.
- Slavin, R. (1987). The Hunterization of American schools. *Instructor*, 96, 56-60.
- Timar, T. B., & Kirp, D. L. (1988). *Managing educational excellence*. New York: The Falmer Press.
- Toffler, A. (1981). *The third wave*. New York: Bantam Books.
- Travis, J. W., & Callendar, M. G. (1990). *Wellness for helping professionals: Creating compassionate cultures*. Mill Valley, CA: Wellness Associates.

